Overview of the NERC Mercury Research Project

BioDiversity Research Institute

- Nonprofit based in Falmouth, Maine
- Primarily collect data on piscivorous birds and mammals
- Study mercury contamination of loons, eagles, osprey, kingfishers, mergansers, otters, and mink
- I conduct the GIS work

NERC Northeast Mercury Research Group

- In 2001 BRI and Environment Canada were funded by Northeastern Ecosystem Research Cooperative (NERC) to assimilate existing Hg databases and created the Northeast Mercury Research Group

- **Project Title:** Assessing the depositional, geological, geographical and biological factors that control mercury distribution in aquatic ecosystems of northeastern North America

- **Co-Investigators**
  - David Evers, BioDiversity Research Institute, U.S.
    - Biology Team Leader
  - Tom Clair, Environment Canada
    - Geochemistry Team Leader

Northeastern Ecosystem Research Cooperative (NERC)

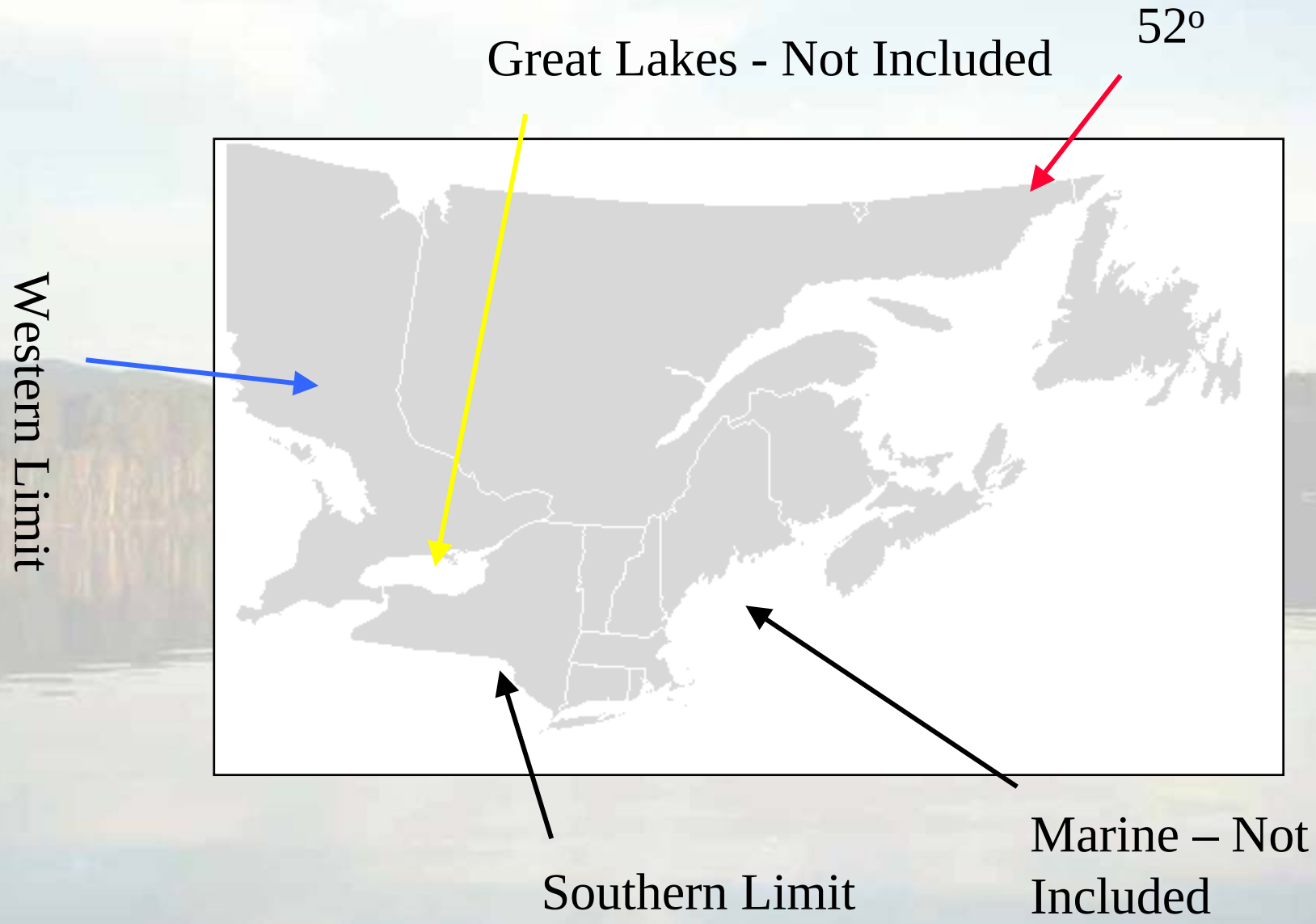
- A USDA funded initiative to promote collaboration among ecosystem research
- NERC's major objects are:
  - (1) initiating joint research projects,
  - (2) sharing data and results,
  - (3) participating in analysis and synthesis of regional environmental issues, and
  - (4) increasing the level of communication among researchers, resource managers, and policy-makers interested in the results of regional environmental research.

Mercury Research Group Partners

- **Individuals representing:**
  - **Federal Government**
    - **Environment Canada**
    - **U.S. Environmental Protection Agency (Jane Copeland, Chris Knights, Ann Kuhn, Jim Lake, Matt Mitro, Diane Nacci, Alan VanArsdale, Jeri Weiss) U.S Fish & Wildlife Service, U.S. Geological Survey**
  - **Many Provincial and State Agencies**
  - **12 Universities, including;**
    - **Clark, Univ., Dartmouth Univ., Syracuse Univ., Texas A&M Univ., Trent Univ., Tufts Univ., Univ. of Maine, Univ. of New Brunswick, Univ. of New Hampshire, Univ. of Pennsylvania, Univ. of Quebec, Univ. of Southern Maine, and Virginia Tech**
  - **Research-oriented, non-governmental organizations**

- **Professional groups:**
  - **Collaborative Mercury Research Network (COMERN) (modeling)**
  - **U.S. EPA – NHEERL-AED (modeling group)**
  - **New England Governors and Eastern Premiers (policy group)**
  - **Northeast States for Coordinated Air Use Management (NESCAUM) (policy group)**
  - **New England Interstate Water Pollution Control Commission (policy group)**

Study Area Aquatic Ecosystems



Northeast Mercury Research Group Workplan

Overall objectives:

1. Document the extent of Hg distribution in northeastern North American surface waters, sediments and key biota

2. Relate that distribution to depositional gradients, land cover, and topography as well as land use.

3. Assimilate data into peer-reviewed (a) inventory papers organized by abiotic compartments and taxa and (b) synthesis papers that describe patterns and relationships. (Ecotoxicology – Biotic and Abiotic)

Data Sharing

- To encourage data sharing the group agreed that data would only be accessible to the group until papers are published

- However data can be accessed by working with the individual project leaders

Workplan, continued

Year 1 (2001-2002)

- Assemble existing data provided by collaborators into one coherent, geo-referenced data set.
- Product: Workshop and web based data repository (46 databases)
- www.briloon.org/NERC/nerc2/index.htm

Year 2 (2002 - 2003)

- Assimilate/analyze data and investigate the relationships between Hg exposure and availability patterns that are influenced by hydrological features, watershed parameters, geochemical aspects, and biological components.
- Product: Workshop and GIS-based relational models & maps

Year 3 (2003 -2004)

- Interpretation of data analysis through the development of support and synthesis papers
- Product: Two workshops and submitted manuscripts (Ecotoxicology -- Abiotic and Biotic)

Workshops

November 2001 workshop in Portland, Maine

- 40 participants (all willing to share their databases)
- Group Team Leaders chosen for the following:
  - Air, deposition – Alan Vanarsdale (EPA)
  - Water & watershed – Tom Clair (Environment Canada) & Jamie Shanley (USGS)
  - Sediments & soils - Steve Norton (UMO) & Neil Kamman(VTDEC)
  - Algae – Celia Chen (Dartmouth)
  - Invertebrates – Chris Pennuto (USM)
  - Fish – Neil Burgess (Canadian Wildlife Service) & Neil Kamman
  - Birds/Herps - David Evers (BRI) & Louise Champoux (CWS)
  - Mammals - Doug Evans (Trent U.) & Drew Major (USF&W)
  - Watershed Processes -- Neil Kamman & Jamie Shanely
  - Models -- Eric Miller (Darmouth) & Keith Robinson (USGS)
  - GIS -- Wing Goodale (BRI) & Gil Pontius (Clark)

December 2002 Workshop

Goals

- Identify information gaps and uncollected Hg databases;
- Determine a preliminary slate of manuscript titles and authors (special issue of *Ecotoxicology*); and,
- Create a slate of manuscripts that will provide the foundation for synthesis papers.

Presentations and Discussions

- Geochemistry related Hg inventories
  - Further seek relationships between water Hg levels and water chemistry
- Biology Related inventories
  - Further seek relationships between Hg levels in different biota
  - Potentially standardize fish data to yellow perch equivalencies
- Watershed & terrestrial processes
  - GIS modeling techniques and areas of special concern

Preliminary Ecotoxicology Paper Titles

Paper #	*Potential Title*	*Potential Authors*
1	Context/Introductory paper (include description of how db assembled)	Clair, Evers
2	Water Inventory/Distribution	Clair
3	Predictability of Hg Concentrations – Water/Sediments…	Pontius
4	Comparative Case Study	
5	Synthesis of Emissions & Depositions – space & time	VanArsdale, Round, Weis
6	Paleological Inventory	Kamman
7	Sediment – very descriptive	Kamman, Perry, Norton
8	Deposition Model	Miller
9	Plankton	Celia Chen
10	Macroinvertebrates – review	Pennuto
11	Fish – distributions by species, size	Burgess, Kamman
12	Fish – "Common Currency" – normalization	Kamman, Burgess
13	Fish – human consumption, game fish	Health Dept (Mark Lucotte)
14	Predictive model using fish as endpoint – ecological, human health	Kamman, Burgess
15	Bird Inventory	Evers, Champoux, Burgess, Major
16	Loon-perch relationship	Evers, Kamman, Major, Burgess, Shuehammer
17	Mammal Inventory	Major, Mayack, Evans, Munney, Evers
18	Wildlife Risk Assessment (may be separate paper & not included in Ecotox issue = outcome of NERC project)	Burgess
19	Modeling	?? Miller, Burgess, Kamman
20	Modeling – watersheds, delivery mechanisms, biodelivery, fish as endpoint (space, time??)	Kamman, Shanley
21	Synthesis paper >> potential for future regulations & human health/consumption advisories	Future synthesis paper

Abiotic

Biotic

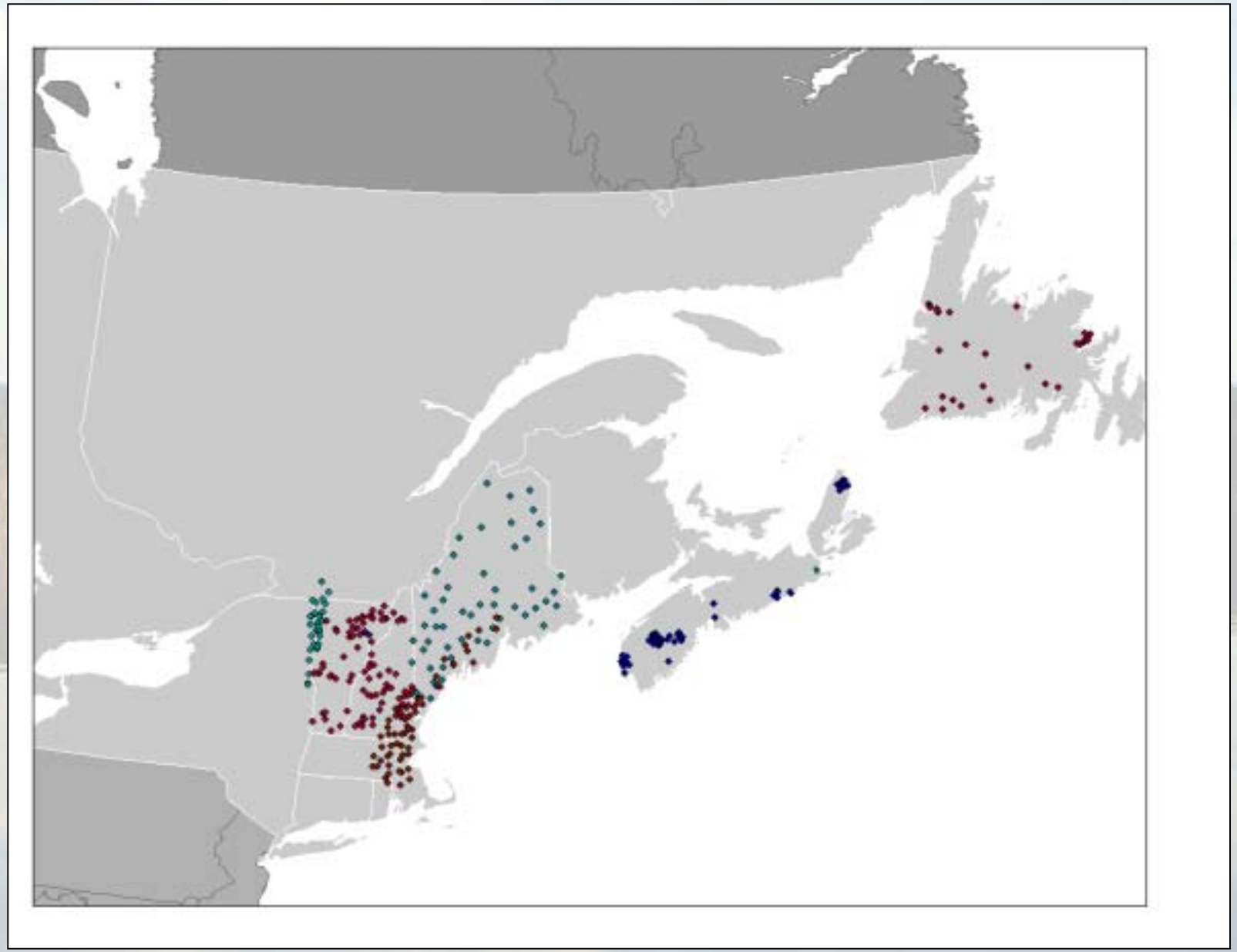
Modeling

Synthesis Papers – *Science or Nature*

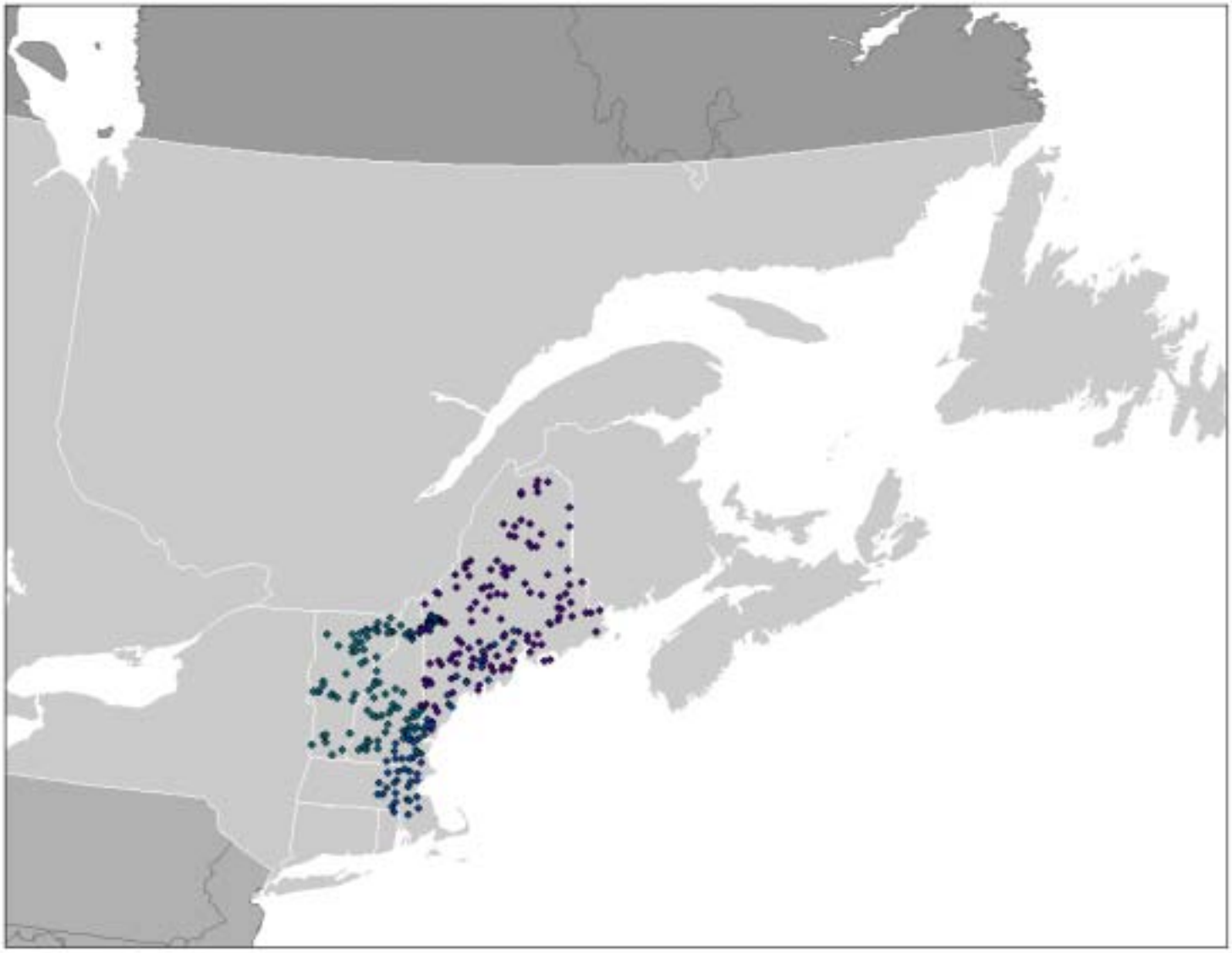
GIS Analysis

- Convert all Hg databases to shapefiles
- Two grad students at Clark University (Idrisi), advised by Gil Pontious, are seeking relationships between Hg levels and landscape features such as topography, watershed size, and land use (Southern NH and Maine REMAP data)
- Graduate student at Virginia Tech seeking relationships within BRI's intensive study area in Rangeley Lakes region of Maine (ArcGIS)
- Eric Miller of Dartmouth and Ecosystem Research Group is estimating and mapping of wet and dry mercury deposition across Vermont & New Hampshire (Idrisi)
- Keith Robinson of the USGS is applying a SPARROW model, used to predict nitrogen and phosphorus loads based on nutrient sources and watershed features, to predict Hg in fish tissue (multivariate regression model).

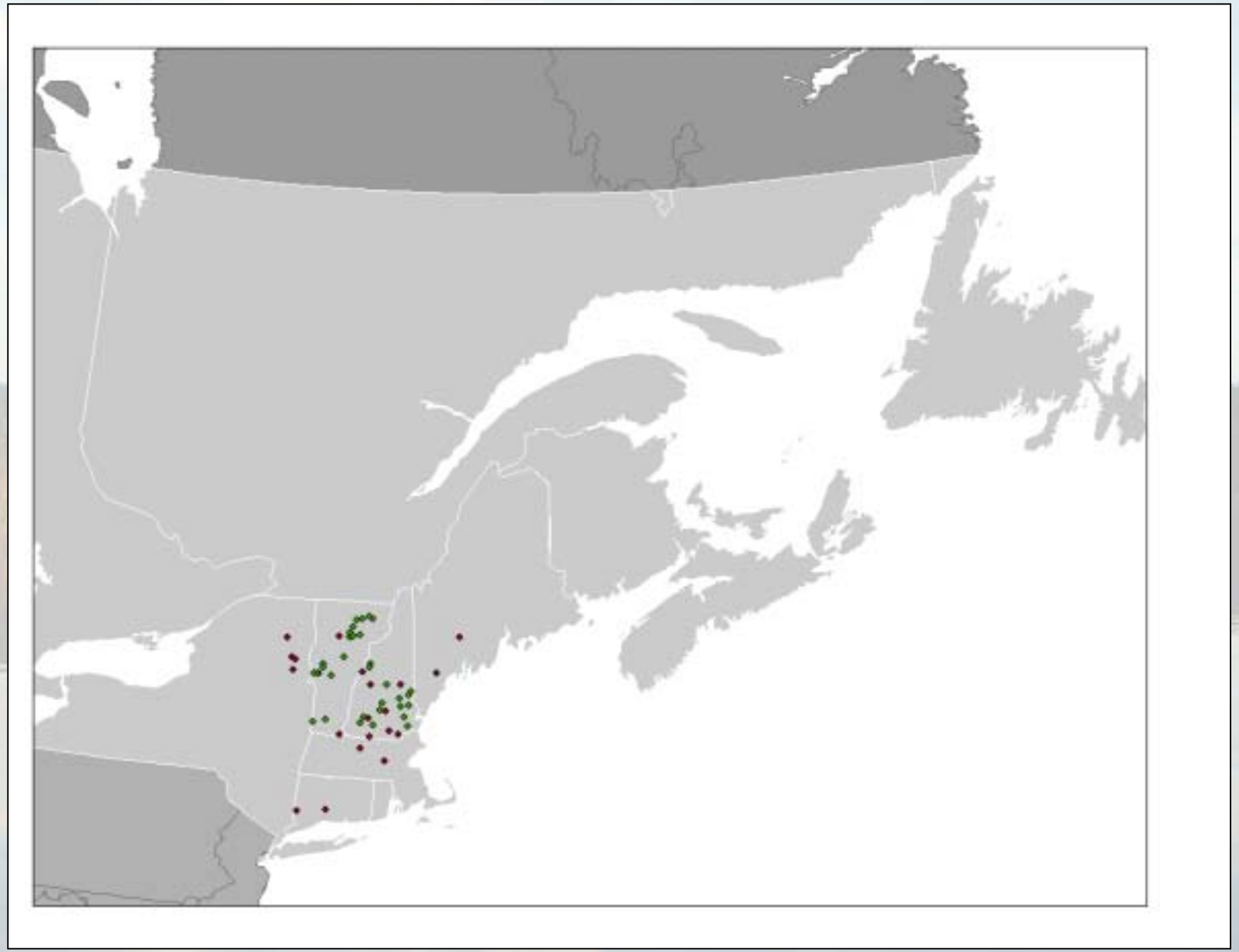
Water



Sediment

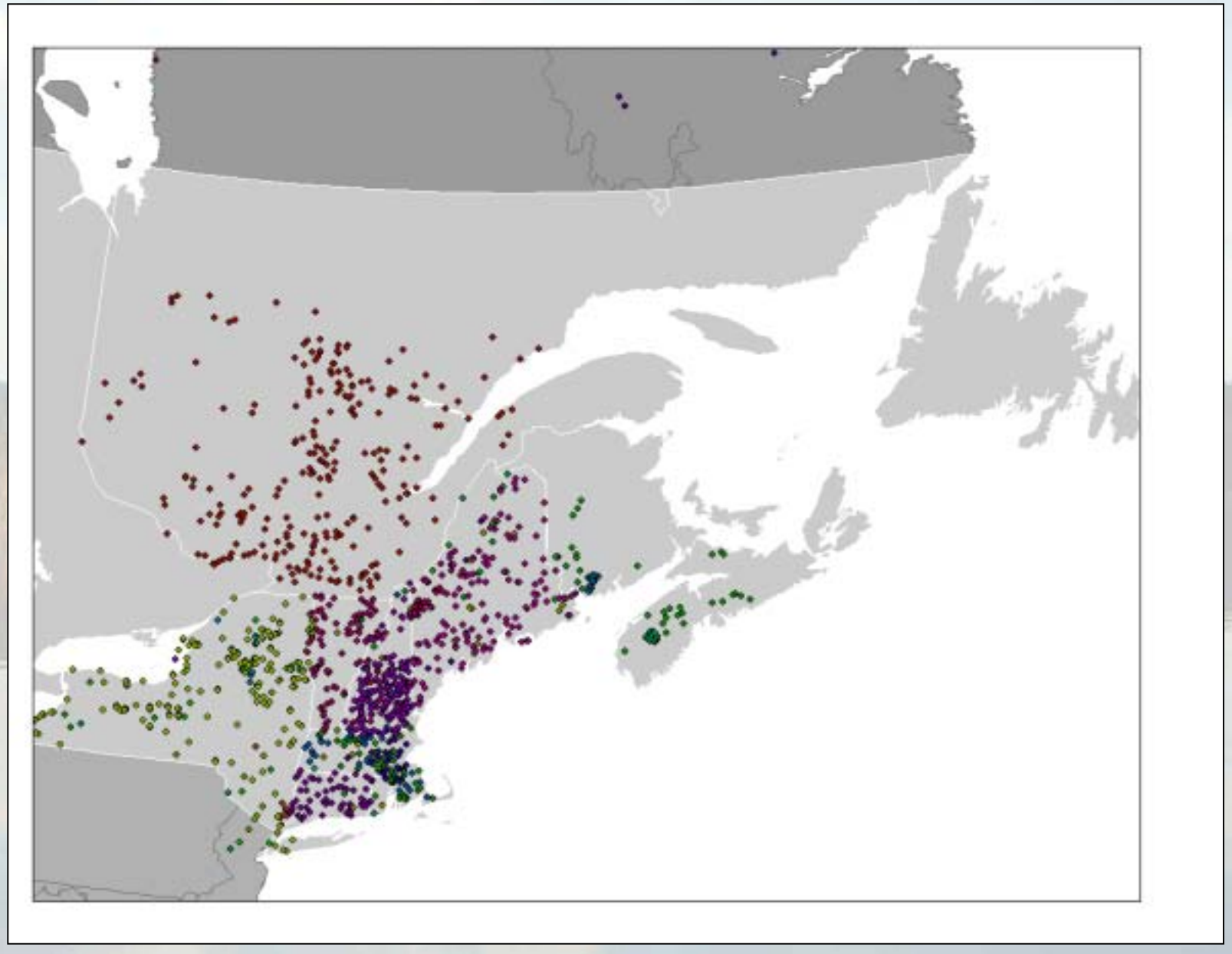


Algae and Plankton

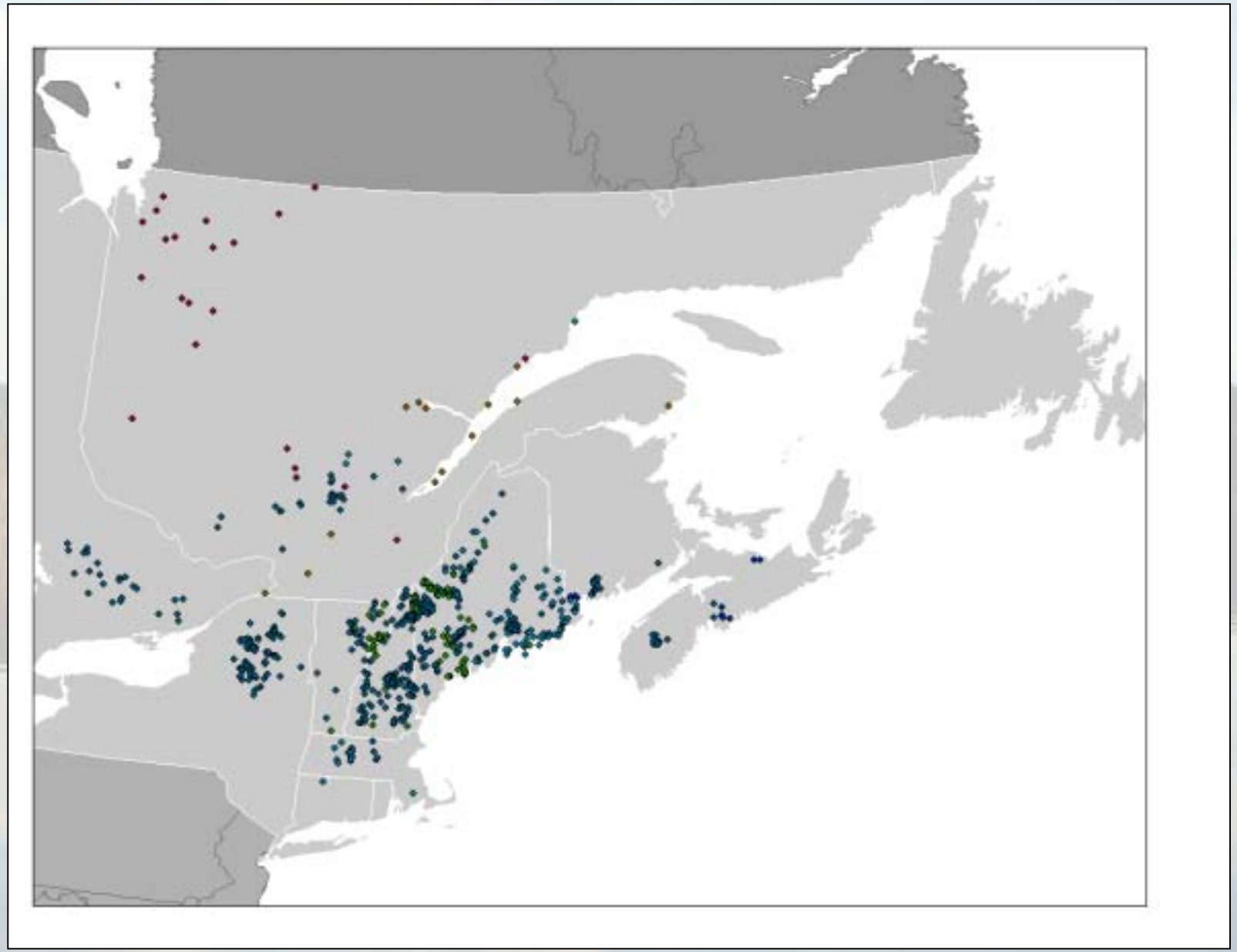


Invertebrates (Crayfish)

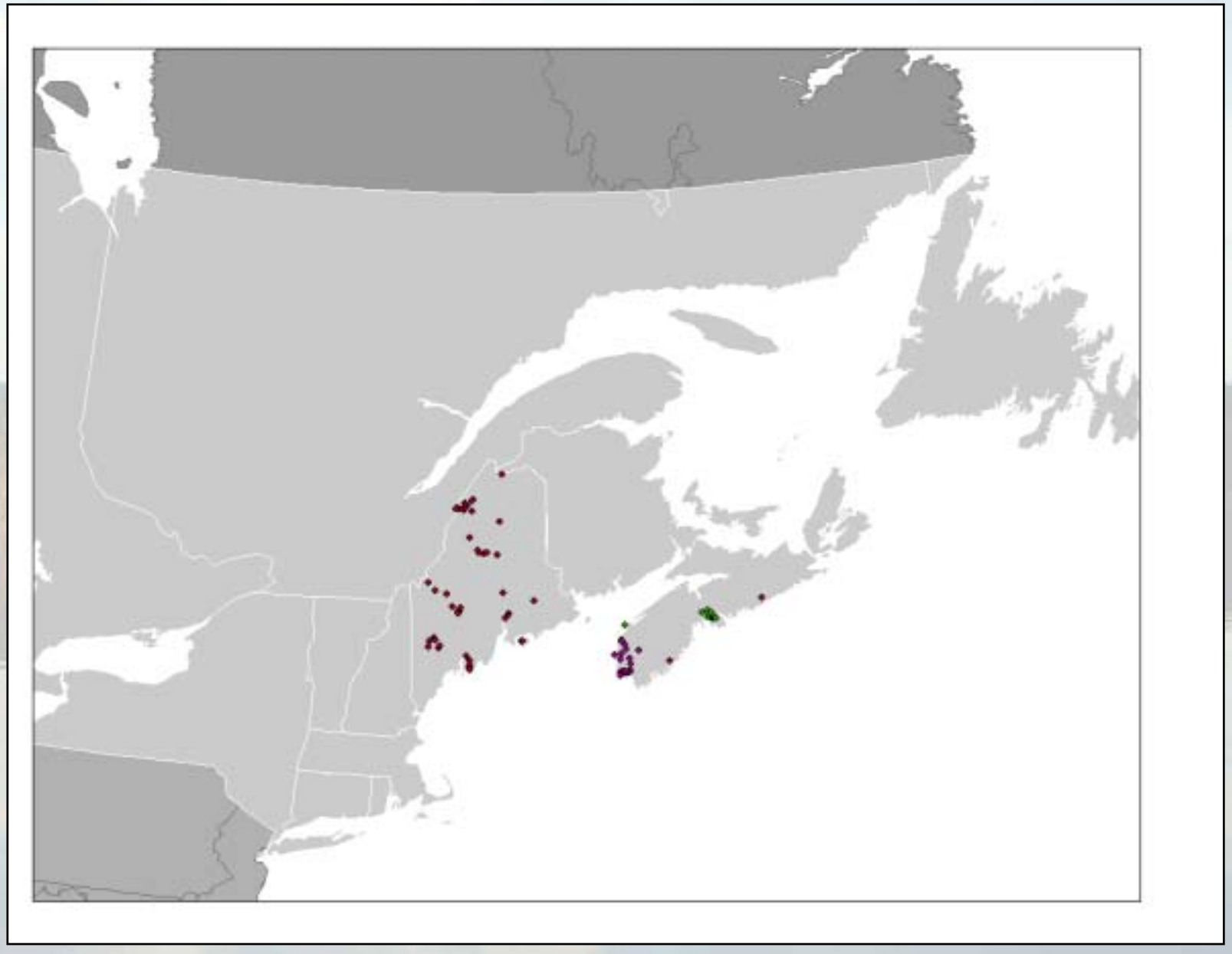
Fish



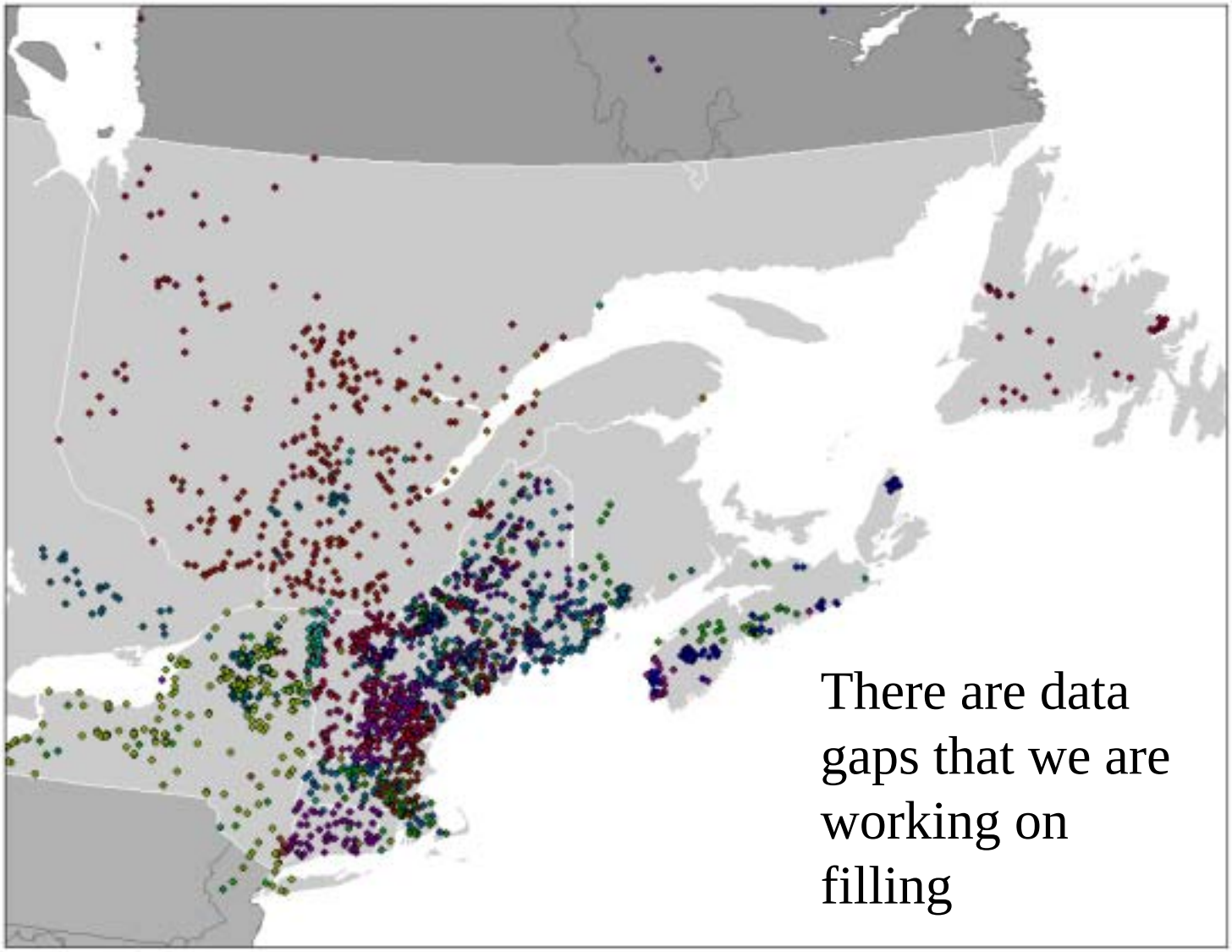
Birds



Mammals



All Data



NERC and the Regional Mercury Modeling Project

- We are excited to be collaborators but because of NERC's data sharing policy we cannot provide unrestricted access to the databases at this time

However

- The website provides contact information for the project leaders and those researchers can be contacted directly
- BRI will help network to these project leaders

Contact Info

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